Establishing A
Virginia Materials Technology Center
"White Paper"

Introduction

Technology leadership is an essential element for continued economic development and industrial growth. On a National level, the top "Critical Technologies List" wherein US leadership is considered essential includes technologies in Energy, Information, Manufacturing, and Materials. These "Critical Technologies" are also essential to the future economic growth of many industry sectors in Virginia. Materials technology is a pervasive commodity that benefits most industries. Advances in materials technology are often a key element in enabling leadership in other Critical Technologies such as Energy, Manufacturing, and Transportation. Virginia is fortunate to have in place most of the essential elements to gain a leadership role in materials technology development and commercialization. An approach to achieving leadership in materials technology is outlined in this "White Paper." Emphasis is placed on a model framework that could accelerate the commercial application of high pay-off materials technologies by Virginia Industries to increase their competitiveness and future economic growth. This framework is consistent with Virginia's Blueprint for Technology-Based Economic Growth. For example, features such as the establishment of partnerships and linkages with Industry, Academia, and the Federal Laboratories will develop a strong materials technology network across the State and take advantage of these valuable assets.

Essential Elements

There are three essential elements required to establish technology leadership. They are:

- Technology Development
- Technology Application & Commercialization
- Responsiveness to Industry Needs in Problem Solving and Education

Virginia has outstanding research and technology development capabilities in materials with demonstrated innovations produced by the research Universities. These capabilities are broad in scope covering metallic, ceramic, polymeric, and composite materials. With the growing development capabilities in electronic materials, Virginia has the full materials technology spectrum that is essential for continued economic growth of the industrial sector. Also, Federal Laboratories produce excellent materials technologies that have significant commercial potential. In Virginia, both NASA Langley and the Jefferson Laboratory are strong in the development of advanced materials and materials related technologies. On a National level, materials technology development receives significant funding and produces new material concepts with commercial potential on a continuing basis. For industry to take advantage of the technology opportunities available within the state and nationally, a dedicated means of alerting industry of the opportunities in a timely manner must be put in place. From this perspective, identifying and "marketing" advances in materials technologies to industry becomes a key link in the commercialization process.

Technology Application and Commercialization of advanced materials technology does not have the focus or infrastructure in place that is required for Virginia to achieve a leadership role. This area requires capabilities, support functions, and industry relationships that go beyond the current strengths, capabilities, and roles of both University and economic development type organizations. To promote and achieve technology commercialization requires a technology resource that is proactive and focused on industry needs and on building industry partnerships within the technology community. These technology partnerships are essential to the process of transitioning a new material technology from the laboratory research stage to commercial reality. For materials, this

process typically involves prototyping the product to be manufactured, demonstrating the economics of a manufacturing process, characterizing mechanical/physical properties, and product verification. Most of the physical resources required to conduct these steps in the technology transition process are available either in the Virginia University laboratories, the Federal Laboratories, or the industrial sector. A focal point and a process for facilitating the partnerships access to the proper facilities and to help nurture the transition process is needed to sustain a productive commercialization capability.

In the materials technology area, Virginia has excellent education programs in place. They are well recognized at both the State and National level. There are selected areas in the State where the materials education program can be enhanced to meet local industry needs. Providing a rapid response to industry needs in problem solving has not been as good as industry would like. From informal industry discussions, identifying who and where help can be found tends to be a time consuming process. Once the right contacts have been made, the technology community has a good track record of responding to industry needs in solving technical problems. Again, this seems to be an area where a focal point and a process to quickly identify problem solving capabilities for industry would greatly enhance the support of commercialization opportunities.

Building Technology Leadership in Materials

An approach to achieving the Essential Elements for technology leadership would be to establish a "Full Service Center (FSC)" for materials technology applications and commercialization. In this context, a FSC would develop and grow the missing links in the Essential Elements outlined above. This development and growth would be accomplished in partnership with industry and with the technology capabilities already in place at Universities and Federal laboratories. Such an FSC entity could provide a focal point to utilize and build on the combined capabilities in materials technology across the State. In a sense, the FSC would be an umbrella organization with electronic linking to technology resources and to industry.

Establishing a FSC that would encompass the all of the key of materials technologies with the intent of meeting a large segment of Virginia industrial needs and interests might be overwhelming as an initial step. A more practical approach is envisioned that would start up with a nucleus of one or two materials technology area nodes. Developing the commercialization capabilities would be more focused and provide an early learning experience from which to evolve and grow the materials technology commercialization capabilities in concert with industry needs.

Important aspects of developing commercialization capabilities for the FSC will be evolving approaches to protect and exploit intellectual property. Another area, especially important to smaller businesses, will be identifying avenues for obtaining technology investment capital. The FSC would be expected to play an important facilitator role in these processes. For example, the FSC could help industry in the process of obtaining a patent license from a University or Federal Laboratory. Similarly, the FSC could provide source listings of potential venture capital companies as well as identifying state and federal sources of capital investments.

Model Framework

A model framework for establishing a FSC for materials is outlined in figure 1. As shown, the FSC would be formed as an operating entity under the sponsorship of the Virginia Consortium of Engineering and Science Universities (VCES). VCES is a consortium agreement between the Universities of William and Mary, Old Dominion, Virginia, and Virginia Tech. Under VCES, the FSC can take advantage of the in-place cooperative agreements with the Universities in the State and the available technical and educational resources to begin functioning immediately. The FSC proposed name is the Virginia Materials Technology Center (VMTC).

Two technology nodes are proposed for the initial start up of the VMTC. They would include the Plasma and Photon Materials Processing Center (PPMPC) and a Polymeric Materials Center (PMC). The PPMPC would focus on photon and plasma processes to tailor and enhance material properties for industrial applications in areas such as microelectronics, semiconductors, and detectors. University partners in the PPMPC include Christopher Newport, Norfolk State, Old Dominion, and William and Mary and the PPMPC would be located in the Applied Materials Center at the Jefferson Laboratory. The PMC would be located at Virginia Tech with a teaming arrangement to incorporate all of the principal polymer capabilities across the state. A summary description of the Materials Processes Center and the Polymeric Materials Center is provided in Appendix A. Future growth opportunities are illustrated in figure 1 to encompass other industrially important materials technology areas such as metallics, ceramics, and electronic materials.

In practice, the Technology Nodes would focus on technology development and problem solving with emphasis on industry needs. The VMTC would provide coordination of the technology development activities and the leadership in establishing industry partnerships and the commercialization activities. To assure effective teamwork in this process, the VMTC leader will serve as a key member of the Technical Advisory Board for each Technology Node. Operation of the VMTC in identifying materials technologies with commercial potential, working with industry partners in commercialization opportunities, and developing a partnership network is summarized in Appendix B.

An Industry led Governing Council would be appointed by the VCES Director. The Council would provide guidance to the VMTC in technology needs and commercialization opportunities as well as periodic assessments of the overall VMTC operation.

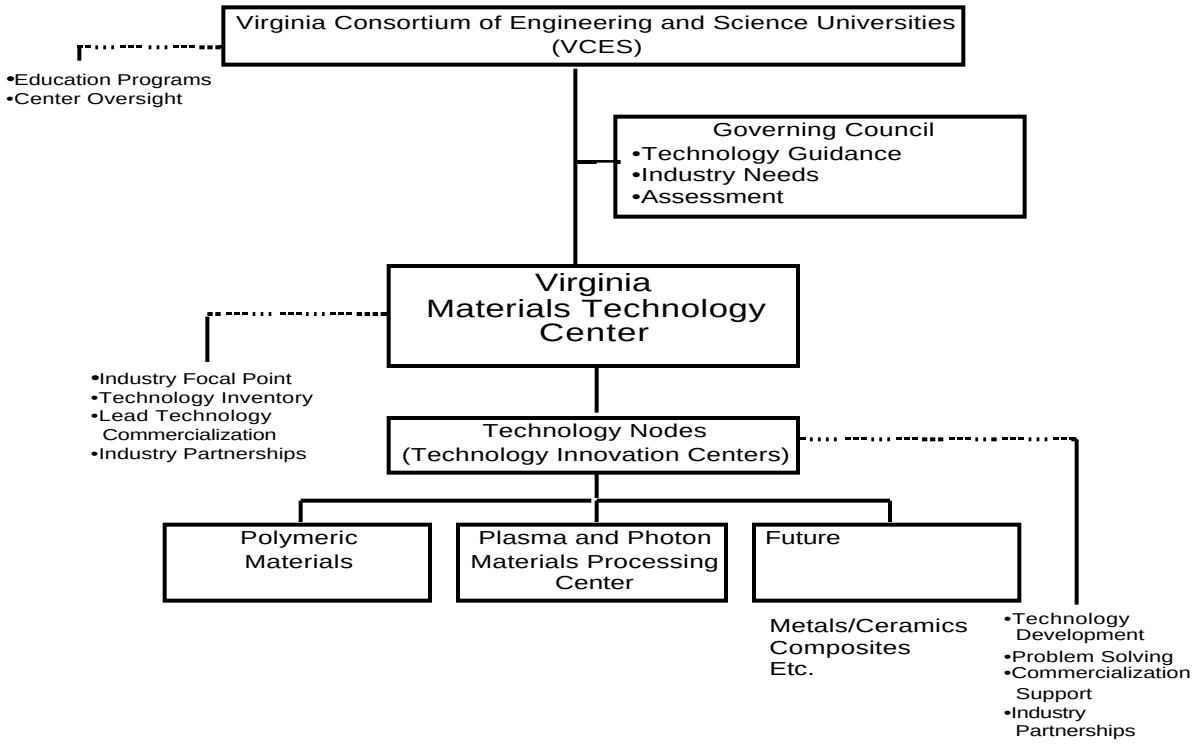
Education Component

The existing agreement between the four VCES universities provides the basis for an expanded educational program in materials. Currently a masters in engineering (M.E.) in materials is available throughout the state through the Commonwealth Graduate Engineering Program (CGEP). VCES is associated with this program. As a part of the proposed VMTC the M.E. program will be expanded to include masters theses at the Hampton Roads site. These theses will directly support development work at the VMTC. In addition, for longer term work, VCES Ph.D. students in materials will be available to work at the VMTC. The VCES agreement allows its graduate students to take courses and receive guidance from faculty from any of the VCES universities. VCES students are all located in Hampton, Virginia while VCES faculty are located both in Hampton and at their home campuses. The VMTC activity will provide the need to significantly increase the number of graduate courses in materials offered at VCES and all of the VCES universities and shared via two-way television. The further use of this two-way television capability will allow real-time sharing of VMTC planning and development.

Summary

This white paper presents an approach to capitalize on the statewide assets that are available in materials technology. These assets in materials technology are key to supporting both existing and emerging technology-based industries in the state as they strive to be more competitive in the global economy. As presented, the model framework outlines a Full Service Center approach to build the essential elements for technology leadership. They include technology development, technology application and commercialization, problem solving, and education. Partnerships with Industry, Academia, and the Federal Laboratories are featured as the key in the process of accelerating the commercial application of high pay-off materials technologies.

VIRGINIA MATERIALS TECHNOLOGY CENTER
FRAMEWORK



Appendix A

Technology Nodes
(Technology Innovation Centers)

Plasma and Photon Materials Processing Center (PPMPC University Consortium
(Christopher Newport, Norfolk State, Old Dominion, and William and Mary)

The PPMPC will focus on photon and plasma processes to enhance material performance for applications in areas such as microelectronics, semiconductor, and detector applications. This technology area is critical to many high-technology business in Virginia. To accomplish the proposed technology development and application activity, the Applied Research Center (ARC) will provide industrial access to the technology faculty and staff members of the four University Partners. In addition, unique facilities that the Consortium brings to the ARC and the Jefferson Laboratory capabilities will be available to support the technology development and commercialization activities. The PPMPC plans to offer a broad range of research and development services, rapid response problem solving and technical assistance, and technology commercialization assistance to industrial firms in the region and across the State.

Center for Polymeric Materials Virginia Tech

The Center for Polymeric Materials will focus on service to Virginia's polymer-based industries. Polymeric materials and processing methods are enabling technologies in many important industrial sectors . The Center will serve as a focal point for polymers technology and allow Virginia companies to more effectively draw upon the technical resources that are available across the commonwealth. This would be accomplished by combining the resources available in the Universities and government laboratories across the State to partner with industry in enhancing their competitive position in polymer technologies. The Center will be positioned to respond to industry requests for short term materials tests and intermediate-term development activities, as well as longer-term fundamental research. In addition, the Center will provide access to continuing education and training to meet industry needs.

Appendix B

Operating Principles for the VMTC

Objective

To promote the growth of materials technology in Virginia with emphasis on technology development, education, and technology commercialization in order to enhance overall industrial competitiveness and economic benefits.

Operation

VMTC will accomplish the stated objective by the following actions:

A. Provide industry with advanced materials technology options/opportunities for new products or innovations by:

>maintaining an inventory of current advances in materials from
University research
Government R&D Laboratories
Industry R&D
for industry review and identification of opportunities

B. With industry partners, lead the transition of selected materials technologies from the research stage to commercial application by:

>Conducting proof of concept development
>Conducting prototype demonstrations
>Establishing manufacturing feasibility

C. Provide materials specialists and support including access to University, Government, and industry facilities/capabilities required to support the technology commercialization activities.

Partnerships

In addition to the VCES, VMTC would establish partnerships with the CIT, Federal R&D Laboratories, other State education and research entities, and Virginia Industry. They include:

A. CIT- VMTC would establish working partnerships with CIT to include their Regional Offices and other Technology Innovation Centers.

B. Federal Laboratories-- Memorandum of Agreements will be established with Federal Laboratories in the State (NASA Langley, DOE Jefferson Laboratory, etc.) to conduct joint commercialization ventures with Virginia industry partners including access to advanced material technologies, technical expertise, and the use of facilities.

C. Industry--An industry partner is a requirement for VMTC to undertake a technology commercialization task. Industry partnerships will be solicited or initiated by industry based on mutual interest in a technology, commercial potential of the proposed technology, and partnership sharing of resources. In addition, VMTC will solicit a broader Industry support of the VMTC to cover some of the operational costs.

D. VMTC-Industry Consortium--For the longer term, a VMTC-Industry Consortium is envisioned that would be a sustaining partnership with the principal leadership and funding provided by the industry partners.

Staffing

VMTC staff will include a Director and technical staff (probably 2-3 full-time members initially) with materials technology and materials characterization backgrounds to lead the technology commercialization activities. They would include expertise in metallic materials, ceramics, polymeric materials, and composites as well as expertise in materials applications such as transportation, industrial products, instruments, optics, etc. VCES will provide most of the support functions within its current operation during the start up of VMTC.

Reporting

The Director of VMTC will report to the Director of VCES. The Director of VCES will establish a VMTC Industry-Government Steering Team to provide oversight and guidance to the VMTC operation. This will include periodic reviews to assure that significant industry needs in advanced material technologies are being met and that significant economic benefits are being realized.